# Operating Experience Weekly Summary 97-47

*November 14 through November 20, 1997*

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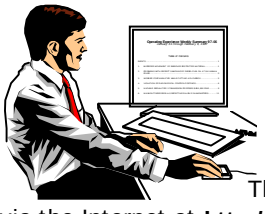

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# *EVENTS*

## 1. DRUMS EXCEED LOWER FLAMMABILITY LIMIT

On November 10, 1997, at the Savannah River Site, operations personnel determined that the process currently used to vent transuranic waste drums may not ensure that hydrogen and oxygen concentrations do not exceed the lower flammability limit. In August, operations personnel vented, purged, and sampled drums packaged before 1988. These drums had not been vented previously. During this operation, they determined that hydrogen and oxygen concentrations in three drums exceeded the lower flammability limit. Operations personnel installed vents and re-sampled the drums; however, the hydrogen and oxygen concentration in two of the three drums still exceeded the lower flammability limit. The facility manager suspended vent and purge operations until a response plan is implemented and corrective actions are completed. Exceeding the lower flammability limit indicates that there is a potentially explosive mixture of gases in the drums. Ignition could result in an explosion that leads to the release of hazardous materials; the contamination of personnel, equipment, and facilities; and the potential for fires and injuries to personnel. (ORPS Report SR--WSRC-SLDHZD-1997-0019)

Investigators determined that the drums contained plutonium waste sealed in plastic bags. Nuclear Filter Technology, Incorporated, designed and manufactured the vent (model FT072), as well as the vent and purge machine used in the facility. Figure 1-1 shows the vent and purge machine.

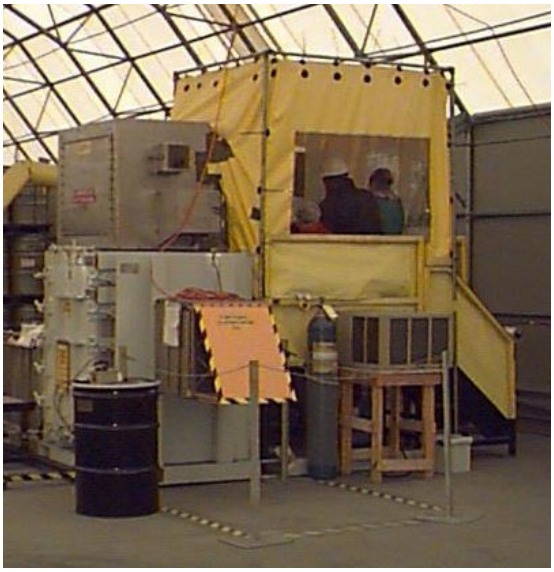

**Figure 1-1. Vent and Purge Machine**

Investigators have not yet determined the cause of this event. The facility manager directed facility personnel to develop a response plan. The response plan includes completion of: (1) an unreviewed safety question evaluation, (2) a probabilistic risk assessment for a hydrogen concentration of more than four percent, (3) a process hazard review for moving and handling drums processed with the vent and purge machine, (4) an increased risk assessment, (5) operating procedure revisions addressing any identified risks, (6) an operator briefing on drum handling, and (7) a management briefing on emergency response plans. The response plan is to

be implemented before operations resume. The facility manager also directed operators to complete the following actions after operations resume.

- Re-vent the drums and determine how long it takes for the hydrogen concentration to remain below the lower flammability limit.
- Determine the diffusion rate for hydrogen, oxygen, and nitrogen through the vent and purge machine filter vent and through the drum vents.
- Determine if experiments on the drums are needed, evaluate any experimental data, and revise operating procedures if necessary.
- Document the applicability of technical safety requirements to legacy waste.

NFS has reported explosions, pressurization, and chemical reactions in tanks and drums in several Weekly Summaries. Following are two examples.

- Weekly Summary 97-22 reported that a waste shipping container at the Fernald Environmental Management Project overpressurized, ruptured, and was damaged by heat generated from an unexpected chemical reaction between uranium, water, and magnesium. (ORPS Report OH-FN-FDF-FEMP-1997-0034)

- Weekly Summary 97-03 reported that a hazardous waste worker at the Fernald Environmental Management Project was loosening a bolt on a 110-gallon drum ring when the lid blew off, striking the ceiling 14 feet above the worker and coming to rest on the floor 3 feet away. (ORPS Report OH-FN-FDF-FEMP-197-0003)

These events highlight the need for managers of facilities to verify that their procedures address the hazards of monitoring, sampling, venting, and handling material that has been packaged and stored for several years. This includes good safety and health reviews together with excellent design, fabrication, inspection, and maintenance of containers. These elements help prevent equipment failures or human errors that might lead to a fire, an explosion, or a release of contaminated materials. In addition, workers need to be aware of the hazards associated with storing, opening, and handling waste containers. Managers at DOE facilities should develop and enforce clear and consistent guidelines and procedures for handling and storing hazardous wastes in containers.

Metal corrosion and radiolytic decay of hydrogenous materials in the waste can be a significant source of hydrogen generation. The rate of hydrogen generation is dependent on the form of the metal and the extent to which water remains in contact with the metal during storage. In this event, water was not present in the drums, but the hydrogen concentrations were higher than expected. Hydrogen generation rates can easily surpass the vent capacity, and result in an explosive mixture of gases. Ignition of the accumulated hydrogen can cause an explosion. Plastic bags are frequently used to contain the metal. They can provide the spark ignition source from static electricity when the plastic contacts the drum wall. Static electricity can be generated on plastic surfaces from drum movement, lower temperatures, or vapor condensation and evaporation caused by temperature fluctuations.

Facility managers should review the following documents to ensure that practices and procedures are adequately implemented.

- DOE O 5820.2A, *Radioactive Waste Management*, establishes the policies, guidelines, and requirements for radioactive waste, mixed waste, and contaminated facilities. Chapter II of the Order delineates requirements for transuranic waste

packaging and temporary storage at generating sites. Specifically, it requires transuranic waste containers to be equipped with a method to prevent pressure build-up and storage facilities to be designed, constructed, maintained, and operated to minimize the possibility of fire, explosion, or accidental release of radioactive or hazardous components to the environment.

- DOE-STD-3013-96, *Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage,* provides a summary of packaging and storage criteria for plutonium metals. It states that plutonium materials must be in stable forms and packaged in containers designed to maintain their integrity under normal storage conditions and during anticipated handling accidents.

- DOE-HDBK-1081-94, *Primer on Spontaneous Heating and Pyrophoricity*, provides information for the identification and prevention of potential spontaneous combustion hazards. The handbook contains information on the effects of atmospheric oxygen, moisture, heat transfer, and specific areas on spontaneous heating and ignition. It also identifies metals and gases known to be pyrophoric, acceptable methods for long-term storage, proper extinguishing agents, and additional sources of reference materials available on these subjects.

- DOE/NS-0013, Safety Notice 93-1, "Fire, Explosion, and High-Pressure Hazards Associated with Waste Drums and Containers," February 1993, describes lessons learned on safe storage and handling of waste containers and drums. The notice specifically discusses handling, storing, venting, and opening containers suspected of being pressurized or containing flammable vapors.

The *Primer on Spontaneous Heating and Pyrophoricity* is available on the Internet at URL http://www.doe.gov/html/techstds/standard/standard.html. Safety Notice 93-1 can be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874. Safety Notices are also available through the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

**KEYWORDS:** pressurized drum, plutonium, hydrogen

**FUNCTIONAL AREAS:** Industrial Safety, Materials Handling/Storage

## 2. CONSTRUCTION WORKER SEVERS ENERGIZED 120-VOLT LINE

On November 13, 1997, at Rocky Flats Environmental Technology Site, a construction worker completely severed an energized 120-volt line while core-drilling a concrete wall to install conduit for an alarm system. He drilled the hole, began area clean-up, and noticed electrical conduit protruding from the concrete core he had removed from the drilled hole. He immediately stopped work and notified his supervisor. The supervisor isolated the area and secured all core-drilling operations. Failure to review facility plans or drawings and obtain engineering approval for this operation resulted in equipment damage and created the potential for injury to the worker. OEAF engineers examined more than 700 electrical occurrences reported across the DOE complex and

found that significantly more electric shocks occurred from alternating current at 120 volts or below. (ORPS Report RFO--KHLL-371OPS-1997-0099)

Investigators determined that the construction manager approved the core-drilling based on a 1996 exemption letter written by engineering personnel after a site-wide shut-down of core-drilling operations. However, the letter was based on an engineer's personal facility knowledge rather than a technical review. The exemption letter stated that there was no embedded conduit in the facility walls. Investigators determined that no one reviewed facility plans or drawings before beginning the work. They also determined that construction personnel failed to show the letter to engineering personnel and obtain their approval before starting the core-drilling as required by facility procedures. Construction personnel inspected the core-drilling area before work began. Based on the 1996 letter, they believed that no electrical wiring was present; however, the severed 120-volt line ran horizontally inside the wall.

The facility manager held a fact-finding meeting and suspended all facility core-drilling activities until an investigation is completed. He also directed facility construction managers to submit a formal policy on core-drilling requirements and told the engineering group to rescind all facility exemption letters.

NFS has reported about severed conduits or cables during construction activities in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-36 reported that a construction worker at Idaho National Engineering Environmental Laboratory cut an energized 208-volt line while core-drilling a cinder block wall to enlarge existing wall penetrations. The construction manager for the primary contractor knew that the line was on the opposite side of the wall, but he did not tell the construction worker during the pre-job briefing. The primary contractor's construction manager properly identified the drilling location on the wall, but the construction worker drilled in another location because a handrail was in the way. (ORPS Report ID--LITC-WASTEMNGT-1997-0021)

- Weekly Summary 97-35 reported that a construction worker at Idaho National Engineering Environmental Laboratory cut an energized 480-volt line while saw-cutting a concrete floor. Investigators determined that project engineer knew that the line was under the floor but failed to recognize that it ran directly under the area where the concrete-cutting took place. The design engineer did not include a drawing showing the line location in the construction package given to the construction coordinator. The facility manager determined that the construction coordinator did not complete a sub-surface survey before cutting began and that no one installed a lockout/tagout. (ORPS Report ID--LITC-SMC-1997-0005)

- Weekly Summary 97-33 reviewed four events where workers severed underground electrical and telephone lines. A subcontractor at Hanford cut an energized 110-volt line while performing renovation activities in a building basement. A contractor at Lawrence Livermore National Laboratory cut an underground energized 480-volt line while using construction equipment to loosen the soil surface. A back-hoe operator at the Hanford Waste Encapsulation and Storage Facility severed an abandoned underground telephone line and an abandoned de-energized electrical cable while excavating. (ORPS Reports RL--PHMC-WESF-1997-0007, RL--PNNL-PNNLBOPER-1997-0023, and SAN--LLNL-LLNL-1997-0051)

These events underscore the importance of using effective work control practices and detailed pre-job planning for construction activities. In the event at the Rocky Flats Environmental Technology Site, lack of work control mechanisms allowed work to proceed without the proper reviews and approvals. The responsibility for ensuring adequate planning and control of work activities resides with line management. Managers should ensure that work control processes are

followed and facility practices are enforced. Safety and health hazard analysis must be included in the work control process to help prevent worker injury and should include provisions for drawing reviews, job-specific walk-downs, personnel protective equipment, and the use of equipment to detect embedded conduit. Pre-job briefings, facility procedures, and training programs should emphasize the dangers associated with excavation activities.

DOE facility managers should ensure that personnel understand the basics of work control practices and work planning. Following are some documents that facility managers should review to ensure they are incorporated in current work control programs.

- DOE O 4330.4B, *Maintenance Management Program*, section 8.3.1, provides guidelines on work control systems and procedures. The Order states that work control procedures help personnel understand the necessary requirements and controls.

- DOE-STD-1073-93-Pt.1 and -Pt.2, *Guide for Operational Configuration Management Program Including the Adjunct Programs of Design Reconstitution and Material Condition and Aging Management*, states that physical configuration assessments or walk-downs should be performed for representative sample structures, systems, and components within the facility to determine the degree of agreement between the physical configuration and the configuration on the facility documentation. Physical walk-downs should be included as part of the programmatic assessments conducted during initial assessments, post-implementation assessments, and periodic effectiveness assessments.

- The *Hazard and Barrier Analysis Guide*, developed by OEAF, discusses barriers that control job-associated hazards, such as physical barriers, procedural or administrative barriers, or human action. The reliability of a barrier is determined by its ability to resist failure. Barriers can be imposed in series to provide defense-in-depth and to increase the margin of safety. The guide includes a hazard-barrier matrix that shows that lockout/tagout is the most effective barrier against injury. When implemented properly, lockout/tagout provides a high probability (greater than 99 percent) of success for risk reduction. The guide provides a detailed analysis for selecting optimum barriers, including a matrix that displays the effectiveness of different barriers in protecting against some common hazards.

A copy of *The Hazard and Barrier Analysis Guide* is available from Jim Snell, (301) 903-4094. A copy may also be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874.

**KEYWORDS:** electrical safety, drilling, cable

**FUNCTIONAL AREAS:** Construction, Work Control, Hazard and Barrier Analysis

## 3. UNDERGROUND CONTAMINATION DISCOVERED DURING EXCAVATION

On November 10, 1997, at the Oak Ridge Y-12 Site, workers unearthed contaminated soil while excavating to install an electric pole in an unposted area adjacent to a controlled area. They performed the work without the required radiological control support. The workers observed some discolored soil in the backfill material and on the auger they used to drill the posthole. However, they did not report this to their supervisor until the next day. The supervisor requested a radiological survey of the auger. Radiological control technicians detected 9,000 dpm/100cm$^2$ fixed plus removable beta/gamma contamination. They also surveyed the excavated soil used to

backfill the pole and detected between 9,000 and 15,000 dpm/100cm$^2$ fixed plus removable beta/gamma contamination in the area immediately surrounding the pole. Although no one was contaminated, excavating in areas next to controlled areas where unknown or undocumented materials or substances may be present creates the potential for personnel exposures or spread of contamination. (ORPS Report ORO--LMES-CENTENGY12-1997-0001)

The workers installed the electric pole adjacent to a posted, controlled area in accordance with a maintenance job request to relocate electrical cables. Although they observed the discolored soil, the workers did not inform the relief supervisor in charge of the job until the next day. They had already removed the bucket truck, auger, shovels, and their company-furnished work clothing from the area.

Radiological control and decontamination personnel decontaminated the auger to below detectable levels of contamination and posted the area surrounding the set-point of the electrical pole as a contamination area. After learning that one of the workers had been splashed in the face with mud when the pole was lowered into the excavated hole, the radiological control technicians surveyed him and the other workers for skin contamination. None was found. Environmental monitoring personnel collected a soil specimen from remnants of the backfill for isotopic identification.

Facility managers are investigating to determine the root cause of this event and to identify corrective actions to prevent recurrence. They are focusing on the work planning process because use of a checklist, which would have initiated radiological support for installation of the pole, was not clearly specified; therefore, work planners did not use one. Facility managers believe the contamination is legacy contamination from past operations involving waste treatment.

NFS reported the following similar events in the Weekly Summary.

- Weekly Summary 97-16 reported that five workers at the Mound Plant contaminated their gloves and boots while taking core samples from an asphalt paved area with known sub-surface contamination. The workers were not wearing anti-contamination clothing. Radiological control technicians discovered alpha contamination (plutonium-238) on the boots of five workers and the gloves of two workers. (ORPS Report OH-MB-EGGM-EGGMAT04-1997-0003)

- Weekly Summary 96-39 reported three events involving unexpected contamination discovered during excavations. At Rocky Flats, radiological control technicians detected 4 million dpm beta contamination on the ground near a crushed drum at a cleanup site outside an industrial area. At the Mound Plant, a facility manager reported the discovery of dark, stained soils that smelled like fuel oil during excavation to install water-diversion piping. At the Weldon Spring Site, a facility manager reported the discovery of unexpected chemicals in soil during excavation work in a restricted zone. (ORPS Reports RFO--KHLL-ENVOPS-1996-0010, OH-MB-EGGM-EGGMAT04-1996-0010 and ORO--MK-WSSRAP-1996-0014)

OEAF engineers searched the complete ORPS database for events reported across the DOE complex involving excavation and the spread of contamination and found 65 occurrence reports. Figure 3-1 shows that facility managers reported management problems as the root cause for 60 percent of the occurrences. Further review shows that 54 percent of the management problems were reported as inadequate administrative control.

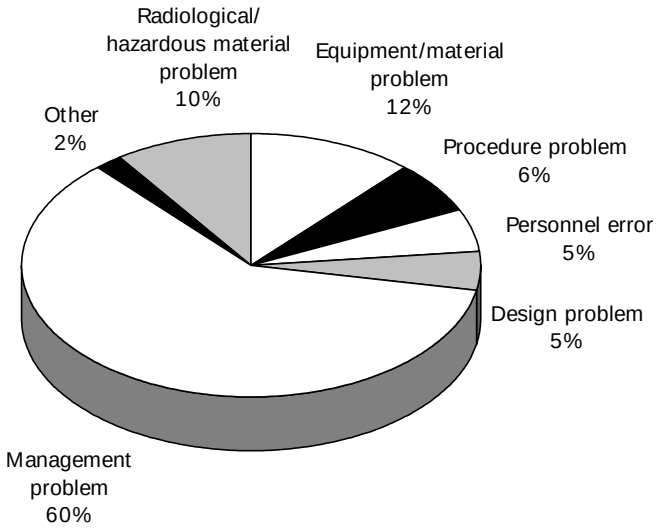


**Figure 3-1. Distribution of Root Causes for Excavation and Spread of Contamination Events[1]**

This event illustrates the importance of planning for possible radiological contamination when developing work packages and maintenance requests. Managers should ensure that work control processes are followed and all potential contamination mechanisms are evaluated. Work planners and job control supervisors should consider past facility operations and the likelihood of legacy contamination when evaluating potential hazards. In suspect areas, where hazards are unknown or undocumented, workers must be more aware of potential problems. The workers in this event did not immediately inform their supervisor when they observed suspicious-looking soil. Waiting until the next day, after they had returned their equipment and gone home, increased the chance for the spread of contamination.

DOE facility managers, supervisors, and workers should review the potential hazards in their work areas, ascertain potential required responses, and determine methods to minimize exposures. DOE O 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*, states that the contractor must identify workplace hazards and evaluate the risk of associated worker injury or illness. The contractor must also assess worker exposure to chemical, physical, biological, or ergonomic hazards through workplace monitoring, including personal, area, wipe, and bulk sampling; biological monitoring; and observing personnel. Contractors must use a hazard prevention/abatement process to ensure that all identified hazards are properly managed.

DOE/EH-0256T, *Radiological Control Manual*, part 7, "Construction and Restoration Projects," article 373, "Other Workplace Hazards," states that radiological controls should be implemented in a balanced way to ensure that protection from all workplace hazards can be implemented. The following hazards should be considered.

- general construction hazards
- confined spaces
- flammable materials
- reactive chemicals

[1] OEAF engineers searched the ORPS graphical user interface database using nature of occurrence "1D, Loss of Control of Radioactive Material/Spread contamination," and all narrative "excavat* OR dig* OR drill* and found 127 reports with 154 events. A 100 percent review of these reports yielded 65 related reports. OEAF engineers determined that each pie slice is accurate within ± 4.34 percent.

- heat stress
- chemical exposures
- energized electrical equipment
- biological hazards
- rotating equipment
- noise and vibration
- excavations

**KEYWORDS:** contamination, excavation, radiation protection, work planning

**FUNCTIONAL AREAS:** Work Planning, Radiation Protection

## 4. FUME HOOD FACE VELOCITIES EXCEED OPERATIONAL SAFETY REQUIREMENT LIMITS

This week OEAF engineers reviewed two recent events at the Los Alamos National Laboratory involving air-flow velocities for containment boxes and fume hoods that exceeded the operational safety requirements. On October 24, 1997, the facility manager for the Chemistry and Metallurgy Research Facility determined that face velocities for hoods and open-front boxes exceeded the specifications in the operational safety requirements. Over half of the 287 boxes and hoods exceeded the limit of 125 linear feet per minute by 50 percent. On November 13, 1997, the facility manager designee for the Plutonium Processing Facility learned that 70 fume hoods used for radioactive material work exceeded the 150-feet-per-minute average face velocity specified in the operational safety requirement surveillance procedure. Investigators determined that this was a Laboratory-wide issue because industrial hygienists had been using anemometers that were not calibrated for the altitude at Los Alamos. The anemometers read approximately 30 percent below the actual indicated measurement, resulting in a 30 percent higher adjustment to air flows. These events are significant because high face velocities can cause turbulence and eddies that could result in the spread of contamination from the hoods. (ORPS Reports ALO-LA-LANL-CMR-1997-0019 and ALO-LA-LANL-TA55-1997-0042)

At the Chemistry and Metallurgy Research Facility, industrial hygienists used hot-wire anemometers to measure the entrance and lateral air velocities in the containment boxes. Their performance-testing procedure required calibrating the air-measuring instruments annually in feet per minute values. The procedure further specified that most manufacturers calibrate anemometers for sea level and that anemometer readings must be corrected for use at Los Alamos because of lower air density (the elevation at Los Alamos is 7,400 feet). Although the procedure specified that the correction factor was necessary, investigators determined that personnel responsible for maintaining and operating the measurement instruments have always assumed that the instruments were self-correcting for altitude. Therefore, they believed that applying a correction factor was unnecessary.

In mid-1997, industrial hygienists learned that there might be a problem with the calibration of the anemometers used at the Laboratory. After an engineering subcontractor balanced a ventilation system at another Laboratory facility, an industrial hygienist determined that facility air velocity readings taken with Laboratory anemometers were significantly lower than those taken with the subcontractor's instruments. After reviewing the readings, the industrial hygienist determined that the Laboratory anemometers were not self-correcting for altitude and the direct instrument readings were actually 30 percent lower than the actual air velocity.

At the Plutonium Processing Facility, Facilities Management personnel and industrial hygienists reviewed the data from the last annual surveillance of the fume hoods and determined that 70 fume hoods were probably outside the specifications of the safe operating procedure. They performed this review in response to an Environment, Safety, and Health Division notice issued

following the calibration problem at the Chemistry and Metallurgy Research Facility. The safe operating procedure for testing fume hoods states that the average face velocity should be at least 125 feet per minute and that hoods exceeding an average face velocity of 150 feet per minute must be evaluated further by an industrial hygienist. Because of anemometer calibration problems, hoods adjusted to the minimum of 125 feet per minute average face velocity actually exceeded 150 feet per minute. An industrial hygienist had not evaluated the hoods, as required.

The resident industrial hygienist evaluated the hoods and concluded that there were no safety problems. Industrial hygienists revised their performance-testing procedures and will re-test the affected hoods throughout the Laboratory. Facilities Management personnel will revise the safe operating procedures for testing the hoods at the Plutonium Processing Facility and will re-test the affected hoods.

NFS reported an event in Weekly Summary 94-11 where confusion over the required face velocity resulted in unauthorized work being performed in a B-box at Rocky Flats that did not meet the operational safety requirement for minimum air face velocity. The B-box, used to sample chemicals, did not meet the minimum face velocity of 150 linear feet per minute. Health and safety personnel measured the box face velocity at 102 to 108 linear feet per minute. They approved its use for chemical sampling based on a health and safety procedural requirement of 100 linear feet per minute. However, the health and safety representative and operations personnel did not consider the operational safety requirement limit. (ORPS Report RFO--EGGR-SOLIDWST-1994-0022)

DOE facility managers should ensure that the instruments testing organizations use to verify and adjust air flows are calibrated for altitude differences or that procedures identify appropriate correction factors that need to be applied to instrument readings. Instruments calibrated by the manufacturer should be operationally verified, tested, and re-calibrated if necessary. DOE O 4330.4A, *Maintenance Management Program*, section II-12, “Control and Calibration of Measuring and Test Equipment,” and DOE-STD-1054-93, *Guideline to Good Practices for Control and Calibration of Measuring and Test Equipment (M&TE) at DOE Nuclear Facilities*, provide guidance for calibrating testing equipment. Section 3.4.1.1, “Procurement,“ in the standard recommends that manufacturers provide a certificate of calibration and tolerance. It also recommends selecting equipment with the proper range, accuracy, and precision.

Proper performance of surveillances is important to guarantee that operational safety required systems are functioning correctly. DOE 5480.22, *Technical Safety Requirements*, general principle 1, states: "A system is considered operable as long as there exists assurance that it is capable of performing its specified safety function(s)." Surveillance testing is essential in providing this assurance.

**KEYWORDS:** calibration, fume hood, operational safety requirement, surveillance

**FUNCTIONAL AREAS:** Licensing/Compliance, Surveillance

## 5. LASER SAFETY VIOLATION

On November 5, 1997, at the Ames Laboratory, experimenters left a Class IIIB laser operating unattended in the alignment mode in violation of laboratory laser safety requirements. A laser safety officer who entered the room where the laser was operating reported that his eyes may have been exposed to the beam. A physician examined the safety officer’s eyes and detected no damage. Class IIIB lasers pose a hazard to the retina, cornea, and lens of the eye when the beam is viewed directly. (ORPS Report CH--AMES-AMES-1997-0003)

Investigators reported that the safety officer passed by the room where the laser was operating and noticed that the door was propped open. No one was in the room. The safety officer entered

the room to investigate and experienced what he thought was an eye exposure to the laser beam. The safety officer reported the incident to the manager of environment, safety, health, and assurance. On November 6, the safety officer reported to the occupational medicine department and requested an eye exam. A physician detected no damage to the safety officer's retina or cornea. On November 11, the group safety representative secured the laser and suspended operations until corrective actions are put in place.

The manager of environment, safety, health, and assurance; the laser safety officer; an industrial safety officer for the laboratory; and the group safety representative met to discuss the event. The meeting attendees determined that the laser operator (a research assistant) was operating the laser in the standby mode (0.9 milliwatts) rather than at full power (30 mW) to align it. They also determined that the operator had not taken the mandatory laser and high-voltage safety training. Attendees also determined that the operator should have performed the alignment operation with the door closed, but he propped open the door for convenience. The Ames Laboratory laser policy documents these requirements. Laser safety requirements are also included in the group's standard operating procedures and in the readiness review documentation for the specific experiment. Corrective actions proposed by the attendees included a beam stop, an interlock with the room door, and strengthened administrative controls.

NFS reported a laser safety violation in Weekly Summary 96-48. A security technician at the Lawrence Livermore National Laboratory was hit in the eyes by the reflected beam from an operating Class IIIB laser when he entered a room to work on an interlock status panel. Investigators determined that a lead experimenter had left the laser on overnight in violation of laboratory laser safety requirements. An ophthalmologist determined that there was no injury to the experimenter's eye. (ORPS Report ALO-KO-SNL-CASITE-1997-0001)

OEAF engineers reviewed the ORPS database for other occurrences involving laser safety violations in 1995, 1996, and 1997, and found one occurrence report describing an event at Sandia National Laboratory–Livermore. In this event, a Sandia employee was attempting to align an unfocused beam from a Class IIIB laser when a stray beam from an optic polarizer he was holding glanced onto his face. An ophthalmologist determined that there was no injury to the employee's eye.

Managers of facilities using lasers should ensure that experimenters understand hazard controls unique to laser operations. Training should include information from ANSI Z136.1-1993, *American National Standard for the Safe Use of Lasers*. This standard provides guidance for the safe use of lasers and laser systems by defining hazard control measures for each of the four laser classifications. Control measures include (1) engineering controls, such as beam housings, beam shutters, and attenuators; (2) administrative controls, such as procedures, warning signs, labels, and training; and (3) personal protective equipment, such as eyewear, gloves, and special clothing. This standard is endorsed in part by DOE O 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*, paragraph 12, "Contractor Requirements Document."

ANSI Z136.1-1993 laser hazard classifications are used to signify the level of hazard inherent in a laser system and the extent of safety controls required. Lasers are grouped into four classes, with Class I being the least hazardous, to Class IV which is the most hazardous. Complete definitions for each class are contained in ANSI Z136.1-1993.

The *Hazard and Barrier Analysis Guide*, developed by OEAF, discusses barriers that provide controls over hazards associated with a job. The guide provides a detailed analysis for selecting optimum barriers, including a matrix that displays the effectiveness of different barriers in protecting against some common hazards. A copy of the *Hazards and Barrier Analysis Guide* is available from Jim Snell, (301) 903-4094. A copy may also be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874.

**KEYWORDS:** industrial safety, laser, training and qualifications

**FUNCTIONAL AREAS:** Research and Development, Industrial Safety, Training and Qualification

## *OEAF FOLLOW-UP ACTIVITIES*

### 1. FOLLOW-UP INFORMATION TO WEEKLY SUMMARY 97-46, ARTICLE 2, PORTABLE EYEWASH STATIONS FAIL TO MEET FLOW REQUIREMENTS

In the article, OEAF engineers reported a problem with Guardian Equipment model G1512 portable eyewash stations. We reported that these stations did not provide flow rates required by ANSI Z358.1, *American National Standard for Eyewash Stations and Showers.* Engineers at the Savannah River Site Central Services Works Engineering field-modified these units by replacing the eyewash head. They tested the replacement head and determined it provides the necessary flow rate.

As a follow-up, OEAF engineers determined that individuals requiring information on this modification should contact Joe Papalski at (803) 725-8454.

**KEYWORDS:** eye wash, test, chemistry, industrial safety

**FUNCTIONAL AREAS:** Industrial Safety, Chemistry

### 2. CORRECTION TO WEEKLY SUMMARY 97-45, ARTICLE 1, UNEXPECTED RELEASE OF NITROGEN DIOXIDE DURING RESIN REGENERATION

A reader contacted OEAF engineers and said the article incorrectly cited the June 1990 *"NIOSH Pocket Guide to Chemical Hazards,"* which identified the immediately dangerous to life or health limit for nitrogen dioxide as 50 ppm. The latest revision to the pocket guide, dated June 1994, identifies this limit as 20 ppm.

OEAF engineers greatly appreciate the positive support and feedback we receive while developing the Weekly Summary. We encourage readers to provide us with information, corrections, and comments.

**KEYWORDS:** operations, procedures, training and qualification, chemical reaction

**FUNCTIONAL AREAS:** Operations, Procedures, Training and Qualifications

## 3. CORRECTION TO WEEKLY SUMMARY 97-44, ARTICLE 4, PIPEFITTER FALLS THROUGH ROOF PENETRATION

A reader contacted OEAF engineers regarding two errors in this article. The article incorrectly cited OSHA regulation 29 CFR 196.501, "Duty to Have Fall Protection," when it said employees rather than employers were required to determine that walking/working surfaces have the strength and structural integrity to safely support personnel. This requirement is clearly the responsibility of the employer. The article also incorrectly stated that a Type C investigation would be conducted by the operating and maintenance contractor. The operating and maintenance contractor is performing an internal investigation of this event.

OEAF engineers greatly appreciate the positive support and feedback we receive while developing the Weekly Summary. We encourage readers to provide us with information, corrections, and comments.

**KEYWORDS:** construction, fall protection, roof, injury

**FUNCTIONAL AREAS:** Construction, Industrial Safety